

WHAT IS CLAIMED IS:

1. A lighting device comprising:

(a) an electroluminescence device which acts as a light source; and

(b) an optical conductor which introduces a light emitted from said electroluminescence device, to a liquid crystal display device,

said electroluminescence device being formed on an end surface of said optical conductor.

2. The lighting device as set forth in claim 1, wherein a face of said electroluminescence device through which said electroluminescence device emits a light is formed in the form of a line in a length-wise direction of said end surface of said optical conductor.

3. The lighting device as set forth in claim 1, further comprising a reflector covering said end surface of said optical conductor to prevent a light having been introduced into said optical conductor from said electroluminescence device, from leaking out of said end surface of said optical conductor.

4. The lighting device as set forth in claim 1, wherein said electroluminescence device is comprised of a plurality of electroluminescence device groups each including a plurality of sub-devices emitting lights having different wavelengths from one another.

5. The lighting device as set forth in claim 4, wherein said electroluminescence device groups are periodically repeatedly arranged in a direction in which sub-devices are arranged.

6. The lighting device as set forth in claim 4, wherein said

electroluminescence device groups are periodically repeatedly arranged in a direction perpendicular to a direction in which sub-devices are arranged.

7. The lighting device as set forth in claim 4, wherein each of said  
5 electroluminescence device groups includes a first sub-device emitting a red light, a second sub-device emitting a green light, and a third sub-device emitting a blue light.

8. The lighting device as set forth in claim 4, further comprising partitions  
10 between which said sub-devices are arranged or which at least partially surrounds said sub-devices.

9. The lighting device as set forth in claim 8, wherein each of said partitions  
15 is comprised of resist.

10. The lighting device as set forth in claim 1, wherein said  
electroluminescence device emits a light having a mixture color of red, green and blue.

11. The lighting device as set forth in claim 1, wherein said  
20 electroluminescence device has a multi-layered structure including a transparent electrode layer, a hole-injecting layer, a light-emitting layer, an electron-transporting layer, and a metal electrode layer stacked in this order as viewing from said optical conductor.

25 12. The lighting device as set forth in claim 1, wherein said electroluminescence device is comprised of a plurality of electroluminescence device groups each including a plurality of sub-devices emitting lights having different wavelengths from one another, and said electroluminescence device has

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a multi-layered structure including a transparent electrode layer, a hole-injecting layer, a light-emitting layer, an electron-transporting layer, and a metal electrode layer stacked in this order as viewing from said optical conductor.

5 13. The lighting device as set forth in claim 12, wherein at least one of said  
10 metal electrode layer, said electron-transporting layer, said hole-injecting layer  
15 and said transparent electrode layer is formed across said sub-devices such that  
20 each of said sub-devices commonly includes said at least one of said metal  
25 electrode layer, said electron-transporting layer, said hole-injecting layer and said  
30 transparent electrode layer.

14. The lighting device as set forth in claim 13, wherein one of said metal  
electrode layer and said transparent electrode layer is formed across said sub-  
devices, and the other has a smaller width than a width of each of said sub-  
15 devices.

15. The lighting device as set forth in claim 13, wherein said light-emitting  
layer and said electron-transporting layer are replaced with a single layer having  
the functions of said light-emitting layer and said electron-transporting layer.

20 16. The lighting device as set forth in claim 13, wherein said light-emitting  
25 layer, said electron-transporting layer and said hole-injecting layer are replaced  
30 with a single layer having the functions of said light-emitting layer, said electron-  
35 transporting layer and said hole-injecting layer.

25 17. The lighting device as set forth in claim 1, wherein said  
30 electroluminescence device emits a light by applying a current to a thin organic  
35 film.

18. The lighting device as set forth in claim 1, wherein said optical conductor is formed with a sawtooth-shaped portion at a first surface through which a light emitted from said electroluminescence device passes outwardly.

19. The lighting device as set forth in claim 18, wherein said sawtooth portion is defined by surfaces extending in parallel with said first surface and surfaces extending perpendicularly to said first surface.

20. The lighting device as set forth in claim 1, further comprising a light-permeable expansion formed on said end surface of said optical conductor, said electroluminescence device being formed on said expansion such that a dispersion angle of a light emitted from said electroluminescence device is reduced.

21. The lighting device as set forth in claim 20, wherein said electroluminescence device has a shape reflecting a shape of a surface of said expansion.

22. The lighting device as set forth in claim 21, wherein said expansion has an arcuate surface.

23. The lighting device as set forth in claim 20, wherein said electroluminescence device is comprised of a transparent electrode layer, a hole-injecting layer, a light-emitting layer, an electron-transporting layer and a metal electrode layer stacked in this order as viewing from said optical conductor, and wherein said expansion has an index of refraction greater than indices of refraction of said hole-injecting layer, said light-emitting layer and said electron-transporting layer.

24. The lighting device as set forth in claim 1, wherein said optical conductor

is formed at said end surface thereof with a recess in which said electroluminescence device is formed.

25. The lighting device as set forth in claim 24, wherein said recess is arcuate.

26. The lighting device as set forth in claim 1, wherein said optical conductor is tapered at at least one of upper and lower surfaces adjacent to said end surface such that an incident angle of a light emitted from said electroluminescence device into said optical conductor is reduced.

27. The lighting device as set forth in claim 4, wherein said optical conductor is tapered around each of said electroluminescence device groups at at least one of upper and lower surfaces adjacent to said end surface associated with each of said electroluminescence device groups such that an incident angle of a light emitted from each of said electroluminescence device groups into said optical conductor is reduced.

28. The lighting device as set forth in claim 1, further comprising a resin entirely covering said electroluminescence device therewith to hermetically seal said electroluminescence device from surroundings.

29. The lighting device as set forth in claim 1, further comprising a sealing cap entirely covering said electroluminescence device therewith to hermetically seal said electroluminescence device from surroundings.

30. The lighting device as set forth in claim 28, further comprising at least one of a deoxidizer and a dehydrator sandwiched between said resin and said electroluminescence device.

31. The lighting device as set forth in claim 29, further comprising at least one of a deoxidizer and a dehydrator sandwiched between said sealing cap and said electroluminescence device.

32. The lighting device as set forth in claim 29, wherein said sealing cap has a function of at least one of deoxidization and dehydration.

33. A lighting device comprising:

- (a) an electroluminescence device which acts as a light source; and
- (b) an optical conductor which introduces a light emitted from said electroluminescence device, to a liquid crystal display device,

said electroluminescence device being at least partially embedded in said optical conductor such that at least one layer among layers constituting said electroluminescence device is embedded in said optical conductor.

34. The lighting device as set forth in claim 33, wherein a face of said electroluminescence device through which said electroluminescence device emits a light is formed in the form of a line in a length-wise direction of said end surface of said optical conductor.

35. The lighting device as set forth in claim 33, further comprising a reflector covering said end surface of said optical conductor to prevent a light having been introduced into said optical conductor from said electroluminescence device, from leaking out of said end surface of said optical conductor.

36. The lighting device as set forth in claim 33, wherein said electroluminescence device is comprised of a plurality of electroluminescence device groups each including a plurality of sub-devices emitting lights having

different wavelengths from one another.

37. The lighting device as set forth in claim 36, wherein said electroluminescence device groups are periodically repeatedly arranged in a direction in which sub-devices are arranged.

38. The lighting device as set forth in claim 36, wherein said electroluminescence device groups are periodically repeatedly arranged in a direction perpendicular to a direction in which sub-devices are arranged.

39. The lighting device as set forth in claim 36, wherein each of said electroluminescence device groups includes a first sub-device emitting a red light, a second sub-device emitting a green light, and a third sub-device emitting a blue light.

40. The lighting device as set forth in claim 36, further comprising partitions between which said sub-devices are arranged or which at least partially surrounds said sub-devices.

41. The lighting device as set forth in claim 40, wherein each of said partitions is comprised of resist.

42. The lighting device as set forth in claim 33, wherein said electroluminescence device emits a light having a mixture color of red, green and blue.

43. The lighting device as set forth in claim 33, wherein said electroluminescence device has a multi-layered structure including a transparent electrode layer, a hole-injecting layer, a light-emitting layer, an electron-

transporting layer, and a metal electrode layer stacked in this order as viewing from said optical conductor.

44. The lighting device as set forth in claim 33, wherein said electroluminescence device is comprised of a plurality of electroluminescence device groups each including a plurality of sub-devices emitting lights having different wavelengths from one another, and said electroluminescence device has a multi-layered structure including a transparent electrode layer, a hole-injecting layer, a light-emitting layer, an electron-transporting layer, and a metal electrode layer stacked in this order as viewing from said optical conductor.

45. The lighting device as set forth in claim 44, wherein at least one of said metal electrode layer, said electron-transporting layer, said hole-injecting layer and said transparent electrode layer is formed across said sub-devices such that each of said sub-devices commonly includes said at least one of said metal electrode layer, said electron-transporting layer, said hole-injecting layer and said transparent electrode layer.

46. The lighting device as set forth in claim 45, wherein one of said metal electrode layer and said transparent electrode layer is formed across said sub-devices, and the other has a smaller width than a width of each of said sub-devices.

47. The lighting device as set forth in claim 45, wherein said light-emitting layer and said electron-transporting layer are replaced with a single layer having the functions of said light-emitting layer and said electron-transporting layer.

48. The lighting device as set forth in claim 45, wherein said light-emitting layer, said electron-transporting layer and said hole-injecting layer are replaced



with a single layer having the functions of said light-emitting layer, said electron-transporting layer and said hole-injecting layer.

49. The lighting device as set forth in claim 33, wherein said  
5 electroluminescence device emits a light by applying a current to a thin organic film.

50. The lighting device as set forth in claim 33, wherein said optical  
conductor is formed with a sawtooth-shaped portion at a first surface through  
10 which a light emitted from said electroluminescence device passes outwardly.

51. The lighting device as set forth in claim 50, wherein said sawtooth  
portion is defined by surfaces extending in parallel with said first surface and  
surfaces extending perpendicularly to said first surface.

52. The lighting device as set forth in claim 33, wherein said optical  
conductor is tapered at at least one of upper and lower surfaces adjacent to said  
end surface such that an incident angle of a light emitted from said  
electroluminescence device into said optical conductor is reduced.

53. The lighting device as set forth in claim 36, wherein said optical  
conductor is tapered around each of said electroluminescence device groups at at  
least one of upper and lower surfaces adjacent to said end surface associated with  
each of said electroluminescence device groups such that an incident angle of a  
25 light emitted from each of said electroluminescence device groups into said optical  
conductor is reduced.

54. The lighting device as set forth in claim 33, further comprising a resin  
entirely covering said electroluminescence device therewith to hermetically seal

said electroluminescence device from surroundings.

55. The lighting device as set forth in claim 33, further comprising a sealing cap entirely covering said electroluminescence device therewith to hermetically seal said electroluminescence device from surroundings.

56. The lighting device as set forth in claim 54, further comprising at least one of a deoxidizer and a dehydrator sandwiched between said resin and said electroluminescence device.

57. The lighting device as set forth in claim 55, further comprising at least one of a deoxidizer and a dehydrator sandwiched between said sealing cap and said electroluminescence device.

58. The lighting device as set forth in claim 55, wherein said sealing cap has a function of at least one of deoxidization and dehydration.

59. A liquid crystal display device comprising:

(a) a first substrate;

(b) a second substrate;

(c) a liquid crystal layer sandwiched between said first and second substrates; and

(d) a lighting device emitting a light through said first substrate, said liquid crystal layer and said second substrate in this order such that a viewer can see produced images through said light,

said lighting device including:

(d1) an electroluminescence device which acts as a light source; and

(d2) an optical conductor which introduces a light emitted from said electroluminescence device, to a liquid crystal display device,

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said electroluminescence device being formed on an end surface of said optical conductor.

60. The liquid crystal display device as set forth in claim 59, further comprising a half-mirror located between said first substrate and said optical conductor.

61. The liquid crystal display device as set forth in claim 59, further comprising:

(e) a brightness detector which detects a brightness around said liquid crystal display device; and

(f) a controller which turns said lighting device on or off in accordance with said brightness detected by said brightness detector.

62. The liquid crystal display device as set forth in claim 59, wherein said electroluminescence device is comprised of a first sub-device emitting a red light, a second sub-device emitting a green light, and a third sub-device emitting a blue light, and wherein images which have to be displayed as red, green or blue images are presented in synchronization with emission of said red, green or blue light from said first, second or third sub-device, respectively.

63. A liquid crystal display device comprising:

(a) a first substrate;

(b) a second substrate;

(c) a liquid crystal layer sandwiched between said first and second substrates; and

(d) a lighting device emitting a light through said second substrate, said liquid crystal layer and said first substrate in this order such that a viewer can see produced images through said light having been reflected at said first

substrate,

said lighting device including:

(d1) an electroluminescence device which acts as a light source; and

(d2) an optical conductor which introduces a light emitted from said  
5 electroluminescence device, to a liquid crystal display device,

said electroluminescence device being at least partially embedded in said  
optical conductor such that at least one layer among layers constituting said  
electroluminescence device is embedded in said optical conductor.

10 64. The liquid crystal display device as set forth in claim 63, further  
comprising:

(e) a brightness detector which detects a brightness around said liquid  
crystal display device; and

(f) a controller which turns said lighting device on or off in accordance with  
15 said brightness detected by said brightness detector.

65. The liquid crystal display device as set forth in claim 63, wherein said  
electroluminescence device is comprised of a first sub-device emitting a red light,  
a second sub-device emitting a green light, and a third sub-device emitting a blue  
20 light, and wherein images which have to be displayed as red, green or blue images  
are presented in synchronization with emission of said red, green or blue light  
from said first, second or third sub-device, respectively.

66. A method of fabricating a lighting device including an  
25 electroluminescence device which acts as a light source, and an optical conductor  
which introduces a light emitted from said electroluminescence device, to a liquid  
crystal display device, comprising the step of (a) forming said electroluminescence  
device on an end surface of said optical conductor.

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67. The method as set forth in claim 66, further comprising the step of (b) forming a light-permeable expansion on said end surface of said optical conductor, said electroluminescence device being formed on said expansion.

5        68. The method as set forth in claim 67, wherein said expansion is formed by injection molding.

69. The method as set forth in claim 67, wherein said step (b) includes the steps of:

10        applying a first material onto said end surface of said optical conductor, said first material having a softening temperature lower than a softening temperature of a material of which said optical conductor is composed; and  
          annealing said optical conductor to soften said first material.

15        70. The method as set forth in 67, wherein said expansion is formed by ink-jet injection.

20        71. The method as set forth in claim 66, further comprising the step of (c) forming a recess at said end surface of said optical conductor, said electroluminescence device being formed in said recess.

25        72. The method as set forth in claim 66, further comprising the steps of:  
          forming a wiring pattern on said end surface of said optical conductor; and  
          electrically connecting a transparent electrode and a metal electrode of said electroluminescence device to said wiring pattern through an electrical conductor.

73. The method as set forth in claim 66, further comprising the step of forming a reflector covering said end surface of said optical conductor to prevent a light having been introduced into said optical conductor from said

electroluminescence device, from leaking out of said end surface of said optical conductor.

74. The method as set forth in claim 66, further comprising the step of tapering said optical conductor at at least one of upper and lower surfaces adjacent to said end surface such that an incident angle of a light emitted from said electroluminescence device into said optical conductor is reduced.

75. A method of fabricating a lighting device including an electroluminescence device which acts as a light source, and an optical conductor which introduces a light emitted from said electroluminescence device, to a liquid crystal display device, comprising the step of (a) forming said electroluminescence device such that at least one layer among layers constituting said electroluminescence device is embedded in said optical conductor.

76. The method as set forth in claim 75, further comprising the step of (c) forming a recess at said end surface of said optical conductor, said electroluminescence device being formed in said recess.

77. The method as set forth in claim 75, further comprising the steps of: forming a wiring pattern on said end surface of said optical conductor; and electrically connecting a transparent electrode and a metal electrode of said electroluminescence device to said wiring pattern through an electrical conductor.

78. The method as set forth in claim 75, further comprising the step of forming a reflector covering said end surface of said optical conductor to prevent a light having been introduced into said optical conductor from said electroluminescence device, from leaking out of said end surface of said optical conductor.

79. The method as set forth in claim 75, further comprising the step of tapering said optical conductor at at least one of upper and lower surfaces adjacent to said end surface such that an incident angle of a light emitted from  
5 said electroluminescence device into said optical conductor is reduced.

80. A method of fabricating a lighting device including an electroluminescence device which acts as a light source, and an optical conductor which introduces a light emitted from said electroluminescence device, to a liquid  
10 crystal display device, comprising the step of:

- (a) stacking a plurality of said optical conductors one on another;
- (b) forming said electroluminescence device on an end surface of each of said optical conductors; and
- (c) separating said optical conductors into pieces.